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Before using a printed copy, verify that it is current by checking the document issue date on the website.

Contents

1. Purpose/Scope

This document describes a field procedure for usage of the NITON X-Ray Fluorescence (XRF) XL700 detector (gold colored cover) to conduct non-destructive testing of potential lead contamination in surface dusts. It is based on methodology described in the Department of Housing and Urban Development (HUD) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* 1990 (revised 1995) and the manufacturer's recommendations and OSHA/NIOSH sampling protocols.

The goal of this SOP is to provide a uniform methodology to determine the presence of lead in surface wipe samples and the concentration of lead detected. Using this method will ensure repeatability between various sampling personnel, substrates and surface configurations. This field procedure describes elements necessary for sampling and analysis.

2.0 Responsibilities

2.1 This program is implemented through the SHSD Industrial Hygiene Group. The IH Group Leader may assign the duties to a *Program Administrator*.

2.2 Members of the SHSD Industrial Hygiene Group, the Radiological Control Division Facility Support Group, Plant Engineering, and other BNL organizations can qualify to perform tasks in this program.

2.3 Personnel, who have demonstrated competency in performing tasks, in accordance with Section 7 of this procedure, will be qualified to serve as a *Qualified Sampler* by their organization management.

2.4 Data Quality Control procedures: The *Qualified Sampler* is responsible for the integrity of the data until properly transferred to the IH Group laboratory using the SHSD established procedures. To have the data included in the SHSD IH group databases, approval of the data by the IH Group Leader or designee is required. Approval will be contingent on documentation that appropriate sampling procedures were followed including: calibration checks before, during and after the work, submittal of an appropriate data form and any other requested documentation to the IH group.

2.5 Hazard Analysis of the Sampling Task: It is the responsibility of the *Qualified Sampler* and his/her supervisor to ensure that training is current and the appropriate personal protective equipment is worn. In addition, the person performing this procedure and his/her supervisor are responsible to ensure that all required training and qualification for hazards that may be present in areas where this procedure will be used (such as respiratory protection or radiological contamination) have been met. The *Qualified Sampler* and his/her line supervisor are responsible to comply with all work planning and work permit system requirements.

2.6 Emergency Procedures: It is the responsibility of the *Qualified Sampler* to know and understand the emergency procedures in case of an accident or loss of the equipment.

2.7 Log In/Out: The *Qualified Sampler* will complete the sign in/out log in the IH equipment room prior to and after each daily use. The instrument is to be returned to the IH equipment room at the end of each days use.

3.0 Definitions

3.1 ***Program Administrator:*** A person designated by the IH Group Leader or SHSD management to administer this procedure and the associated program of XRF data management.

3.2 ***Qualified Sampler****:* A person who has demonstrated competency, in accordance with Section 7, to perform this field procedure and is approved to independently use the Niton XL-700 series device and interpret results.

3.3 ***Lead Contaminated Surface:*** Any surface area (floor, wall, furniture, or other building surface), which has resulting lead concentration that exceeds the levels as established in the wipe sampling protocol.

3.4 ***XRF Performance Characteristic Sheet:*** Manufacturer's technical data sheet providing information on the instrument use characteristics including: positive, negative and inconclusive ranges of the detector and substrate corrections if any are necessary.

4.0 Prerequisites

4.1 **Meter Use Tracking:** A sign in/out log is required for distribution of the instrument and will be completed prior to and upon return of the instrument. Required information includes the Qualified Sampler's (user's) name, location(s) the instrument will be used, and a phone or pager number allowing contact of the user while the instrument is in their possession.

4.2 Qualification as per section 7 of this SOP.

5.0 Precautions

5.1 **Hazard Assessment:** For all work done under this SOP, a hazard assessment need to be done to determine the inherent hazardous conditions of the area and appropriate protective measures based on the hierarchy of controls.

5.2 **Work Planning:** All requirements of work permits and work planning system reviews must be met in performing this procedure, as applicable.

5.3 **Waste Disposal/Pollution Prevention:** Prior to project initiation, all waste generation anticipated will be evaluated to determine if product substitution, process

changes or other recommended alternative actions can be utilized to eliminate/minimize waste generation and/or environmental degradation. After analysis, the samples must be considered for hazardous waste disposal if elevated levels are detected. EWMSD is to be consulted for proper waste disposal of samples.

5.4 **Personal Protective Equipment:** Appropriate personal protective equipment to protect the person collecting and analyzing the sample must be used when implementing this procedure. Each area entered for testing must be evaluated for required personal protective equipment. Personal Protective Equipment that may be needed includes:

- Appropriate respirator and filter cartridges for bulk sampling lead based coatings.
- Gloves (latex, Nitrile, or PVC disposable or reusable style).
- Protective clothing for protection from lead dust (Tyvek®, Kleenguard® or equivalent.
- Gloves and protective clothing for protection from radiological of dust/paint chips when dealing with radiological contaminated surfaces.

5.5 **Radiological Hazard & Contamination:**

5.5.1 It is possible that some surfaces to be tested may have radiological contamination. In these cases, personal protective equipment and administrative controls must be implemented for the radiological contaminant hazard of the surface as well as the instrument. In addition, samples must be analyzed for radiological hazard before they can be submitted to the IH Group for analysis. At no time will the IH Group accept a sample with radiological contamination above permissible limits for the general public.

5.5.2 The meter contains a regulated radiological source and must be transported only within the original manufacturer supplied instrument case. The *Qualified Sampler* must maintain possession with the meter at all times or store the meter in a limited access controlled area (such as a locked vehicle or locked room or locked cabinet).

6.0 Procedure

6.1 **Equipment**

6.1.1 NITON XL700 series XRF Meter and spare battery in original case.
6.1.2 Barcode reader and laminated barcode sheet.
6.1.3 National Institute of Standards and Technology (NIST) Standard Reference Materials (SRM) standard for verifying calibration.

6.2 **Documentation** (items 6.1.4.1-4, found in zip-lock bag under the upper case insulation).

6.2.1 Factory calibration sheet.
6.2.2 Valid instrument wipe test report.
6.2.3 Emergency Notification Sheet.
6.2.4 Performance Characteristic Sheet.
6.2.5 XRF Data Reporting Sheets.
6.2.6 Wipe Sampling Form and Chain of custody form.

6.3 **Turning On and Calibration:** Calibration verification is to be done in the IH office prior to removal to the field, at the beginning and end of each new test area, after no more than 2 hours of use and at the end of usage when returned to the IH office. Calibration checks should be done every time the instrument is turned on and prior to turning it off including work breaks.

6.3.1 Turn on the XRF and allow 15 minutes for the unit to warm up.
6.3.2 On the left end of the unit is a rolling switch. Turn the dial to the left until the unit clicks into place showing the blue line. This will select the Cadmium 109 source.
6.3.3 Select the test mode menu on the XRF with the clear/enter key then select Thin Sample mode and then Dust Wipes.
6.3.4 Check the time and date settings then select calibrate/test mode. If the Cadmium 109 source is not selected, the instrument will ask you to select the source.
6.3.5 The unit will self calibrate and return ready to test. "Dust Wipe" mode will show on the readout.

6.4 Collect a wipe sample is detailed in SHSD SOP IH-75190 *Surface Wipe Sampling Procedure*. An employee listed as a Qualified Sampler under the surface wipe sampling procedure may collect the field samples. Duplicate samples may be collected for confirmatory laboratory analysis or the test samples may be sent for laboratory analysis.

6.5 Further preparation of the field sample is necessary for analysis by the XRF. The sample will be folded three additional times to create a sample pad measuring 1 x 1.5 inches (2.5

x 3.7 cm). This is then placed very neatly into a plastic baggie provided for this purpose. The baggie is then placed in the metal dust wipe holder and is now ready to test.

6.6 To ensure that the entire area of the wipe is measured, **four (4) analyses must be taken for each dust wipe sample** as detailed below. The unit will average the results and provide a single number for the quantity of lead on the wipe.

6.7 **Field Calibration Check**

6.7.1 Perform a pre-test calibration. To take a reading with the Niton XL-700 series unit, set the test platform on a flat, solid surface.

6.7.2 Place the test standard in the holder and the holder in the number 1 spot on the base. Place the instrument on the standard with the window fully on the standard. Slide the shutter release lock forward from under the release switch. Depress the switch and hold while placing the unit flat on the sample. Move the unit forward without moving the sample until the catch engages on the unit and holds it in place. The unit is now analyzing the sample and you may let go of the switch. After approximately 60 seconds (nominal) of testing remove the unit and allow the plunger to fully extend below the unit.

6.7.3 Move the standard to the Number 2 position and retest. Turn the standard around 180 degrees without turning it over and repeat tests in the number 1 and 2 locations. The final average reading should be between 420-580 micrograms. Report the average reading on the data sheet.

6.7.4 When sampling is completed, before turning the unit off conduct a post calibration of the unit with the standard.

6.7.5 Turn the instrument off (by sliding power switch to “off”, lock the shutter release, store in the original case and return the meter and documentation to the IH lab.

6.8 **Recordkeeping:** The user may maintain a copy of the Niton software at a remote location and the data downloaded for the sample numbers created by the user. However, no data is to be deleted prior to returning the instrument to the IH lab. Only the IH Group Leader, Program Administrator or the lab technician shall delete data and then only after verification that the data has been retrieved and saved.

6.8.1 All paper work should be checked by the lab technician or designated Industrial Hygienist upon return of the instrument. In addition, he/she will perform a physical check of the instrument, case and accessories.

6.8.2 The stored data may be downloaded for comparison to the recorded field form and a copy will be provided to the user for their records.

6.9 **Conduct field testing**

6.9.1 Enter the surface wipe location and sample number and other test information on the data sheet.

6.9.2 Select a location for testing which allows the unit in the holder to remain flat and ensures that the user and any other room occupant is not in direct line with the direction of sample beam as shown on the front of the unit.

6.9.3 Place the NITON flush in the holder with the meter window completely on the sample surface, squeeze and hold the shutter release. The unit will lower onto the surface and the plunger will move up above the top of the unit. The holder will slip over the top end of the unit holding it in place. You may let go of the shutter release, however, do not move the instrument during the test period.

6.9.4 When the test interval is complete, move the holder off the top of the unit and remove the NITON from the test surface. The plunger should automatically return to the down position. Ensure that the plunger moves down completely allowing the shutter release safety slide to move under the shutter release.

6.9.5 You are now ready for the next reading as detailed above. Complete the four readings and record the average reading on the data sheet.

6.9.6 When a Data sheet is filled, begin another sheet by completing Section 1 and including the number of pages.

7.0 Implementation and Training

7.1 **Background Training**:

7.1.1 RadWorker 1 (HP-RWT002) or RCT Qualified

7.1.2 Training - Lead In The Workplace awareness training TQ-LEAD 1

7.1.3 Review of the Lead Subject Area

7.2 For SHSD personnel, the SHSD Industrial Hygiene Group Leader or Lead Program Administrator will qualify personnel in the use of, and interpretation of results for, the Niton XL-700 Lead Analyzer using ***Attachment 9.5.***

7.3 **Qualification Criteria:** For all BNL personnel, the qualification criteria to perform this procedure are:

7.3.1 Manufacturers training provided by either a qualified manufacturer's representative or a BNL employee who has received the Manufacturer's training.
7.3.2 Knowledge of industrial hygiene practice (awareness level).
7.3.3 Specific knowledge of this procedure.
7.3.4 Demonstrated competency in performing this test to the satisfaction of their line management via:
- Visual observation of proper detector usage technique.
- Ability to answer questions on the sampling procedures, custody of the instrument and emergency procedures during sampling and transportation.
- Knowledge of the appropriate personal protective equipment for the hazards of this particular type of sampling.
- Knowledge of the appropriate personal dosimetry required for documentation of exposures.

7.3.5 **Qualification Frequency & Recordkeeping:** Qualified persons will be tracked in the Office of Training and Qualification system.
7.3.5.1 Personnel shall be re-qualified at a frequency not to exceed three years, provided there is no break in the work assignment that utilizes this procedure.
7.3.5.2 If a person has not performed instrument usage for a period of over 6 months from the date of last qualification, demonstration of competency to perform this procedure to the satisfaction of the Program Administrator, the IH Group Leader or a designee of the Program Administrator will be required before sampling commences.
7.3.5.3 If significant and substantive changes to the procedure are made, *Qualified Sampler*s will be notified of the changes.

8.0 References

8.1 NITON Corporation, "300 Series & 700 Series User's Guide, version 5.2", 1998.

8.2 U.S. Department of Housing and Urban Development, "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, Ch. 7, Lead-Based Paint Inspection", 1997.

8.3 U.S. Environmental Protection Agency, "Method 6200 and Field Portable X-ray Fluorescence", 1998.

8.4 National Institute for Occupational Safety and Health (NIOSH), "Method 7702, Lead by Field Portable XRF", Jan. 1998.

8.5 BNL SBMS *Lead* Subject Area.

9.0 Attachments

9.1 **Theory of Sampling**
9.2 **Photograph of Meter**
9.3 **Short Operating Instructions**
9.4 **Niton LBP X-ray Fluorescence Meter Form**
9.5 **Job Performance Measure (JPM) Completion Certificate**

10.0 Documentation

Document Review Tracking Sheet		
PREPARED BY: *(Signature and date on file)* **J. Peters** **SHSD IH Group** **Date 11/13/01**	**REVIEWED BY:** *(Signature and date on file)* **R. Selvey** **SHSD IH Group Leader** **Date 11/14/01**	**APPROVED BY:** *(Signature and date on file)* **R. Selvey** **SHSD IH Group Leader** **Date 11/14/01**
Filing Code: **IH51SR.01**	**DQAR** **Date:**	**Effective Date:** **02/28/01**

Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
03/09/01	*(Signature and date on file)* R. Selvey	Added "Leak Test Date:" to sample form, revised SOP number from IH-FP-161 to new system IH10390

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH103910** REVISION **FINAL Rev1**
SUBJECT: INSTRUMENT OPERATION: **Detection of Lead in Wipe Samples by** **NITON XL700 X-Ray Fluorescence Meter**	DATE **10/08/04** PAGE **10** OF 14

10/07/04	*(Signature and date on file)* R. Selvey	Updated format to Section 7 *Implementation and Training;* some text changed throughout the document to reflect minor changes in administrative; corrected the format of cells for electronic data entry to Attachment 9.4; added Attachment 9.5 for qualification of samplers. SOP number changed to reflect the new system.

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Attachment 9.1
Theory of Operation

XRF testing is a quick method for initial determination of the lead content of wipe samples. Laboratory analysis of wipe samples is currently the only accepted method for regulatory compliance. The selection of the test locations should be representative of the surface, which is most likely to be contaminated with dust having a lead content and accessible to workers or the public. The number of samples to collect and analyze should be determined on an individual basis by a trained professional.

Individual wipe samples can be visualized as four quadrants and the wipe will be tested four times (once for each quadrant) with the final result reported as the average of the four tests. The average test result is the final determination of the lead content. This is necessary due to the small size of the test window and to ensure the entire sample is tested by the instrument.

XRF results are reported in micrograms of lead. The lead in dust concentration must be calculated by dividing the content in micrograms by the area wiped converted to square feet (100 square centimeters = 0.108 square feet).

For a wipe sample of 100 square centimeters use the formula:

Lead concentration in micrograms per square foot = micrograms of lead per sample/0.108

For a wipe sample of 1 square foot use the formula:

Lead concentration in micrograms per square foot = micrograms of lead per sample/1.0

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Attachment 9.2
Photograph of Meter

Source Selector

Plunger

Serial Port

On-Off Switch

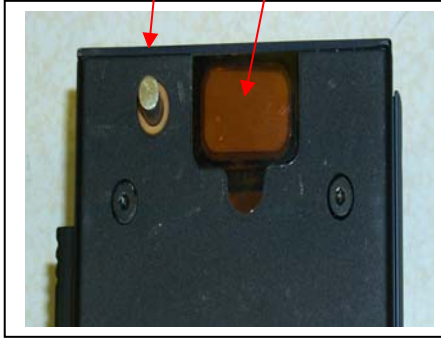
LCD Display

Trigger

Enter / Scroll Keys

Shutter Release

X-Ray Window



BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH103910**
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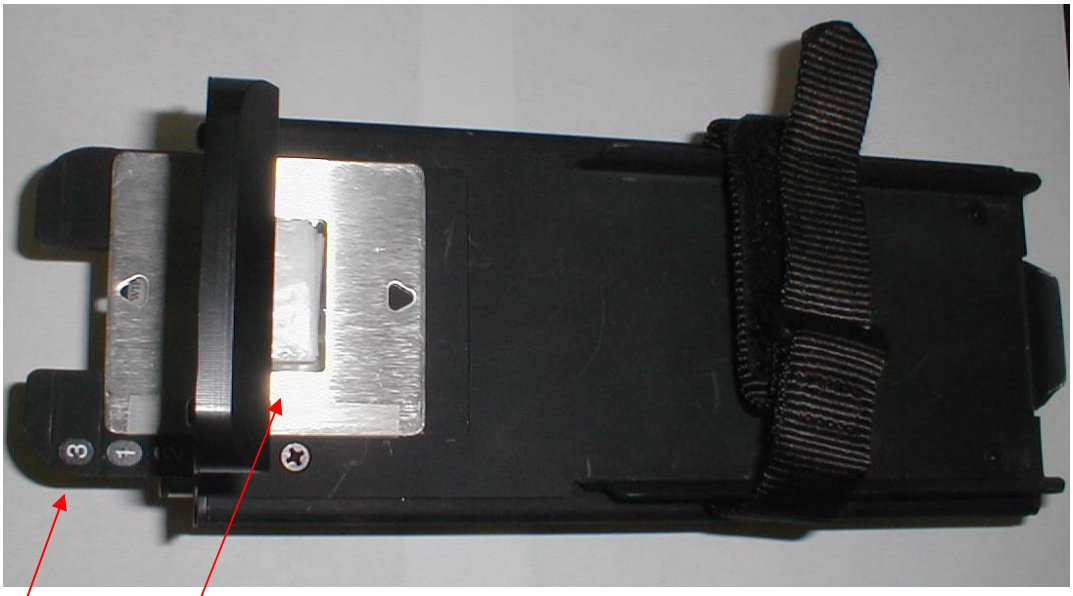

Sample holder with sample

Numbered Test Locations

Holder for XRF

XRF in Sample Mode Location

Attachment 8.3

Short Operating Instructions

	Step	User Action	Display
1	**Turning On**	Move the on/off switch pass setup to the ***ON*** position	*Unit runs through "System Diagnostics"*, then "Cooling Detector and Reducing BIAS Voltage" "*Calibrate & test* *Select Test Mode ->* *Setup/specs. ->* *Download/Erase Data ->"* *Mode: Dust Wipes* *Date Time"*
2	**Pre-Calibration**	Select "Calibrate and Test" by pressing **[clear/enter]**	*"Calibrating" runs*, then "Starting Please Wait nn% Complete" After 1-2 minutes the instrument will display *"- - > Ready to Test <- - ".*
		Measure the "standard wipe". Place wipe in metal holder then place holder in the test platform No.1 space. Move the shutter release lock forward and press the shutter release in, hold in while placing on test surface and locking into position. Repeat for test nos. 2, 3, & 4.	*"Reading #nnn".* After 60 nominal seconds of testing remove the unit and allow the plunger to fully extend beneath the unit. Move sample and continue testing as noted. When completed the unit will report the "final result" in micrograms of lead. Result should be between 420-580 micrograms.
3	**Taking Readings**	Enter the sample number, sample location and other field information on the field data sheet. Place a sample in the holder and put the holder in the no. 1 position on the platform. Continue with tests No. 2, 3 & 4.	When completed the unit will report the "final result" in micrograms of lead. *Enter the test numbers and final result on the field data sheet.*
4	**Post-Calibration**	Repeat step 2 above.	
5	**Turning Off**	Move the on/off switch pass setup to the ***OFF*** position & lock the shutter release.	Display goes blank

BROOKHAVEN NATIONAL LABORATORY
SAFETY & HEALTH SERVICES DIVISION

DIRECT READING INSTRUMENT – Wipe Sample Analysis
NITON X-Ray Fluorescence Meter (XRF)

DATE:	SURVEYOR(S):	Sheet ____ of ____

I. AREA INFORMATION

DEPT:	BLDG:	ROOM:
Work Control Project #:		
Supervisor:		

II. EMPLOYEE INFORMATION

This section is not typically applicable. Use comment section for recording employee exposure information if available.

III. SURVEY INSTRUMENT INFORMATION

INSTRUMENT: **NITON XRF**	MODEL**: XL-700 (Gold Colored Case)**	SERIAL#: U1932 BNL#: 116903
FACTORY CALIBRATION DATE:	SOURCE: Cd 109 10 mCi	DATE SOURCE INSTALLED: LEAK TEST DUE:

IV. SAMPLING INFORMATION & RESULTS

Pre-sampling Calibration Data						**Post-sampling Calibration Data Date:**_____					
Sample #	Test numbers				Average Wipe Result	Sample #	Test Numbers				Average Wipe Result

Calibration Data Within Appropriate Range (420-580 ug) ? _____YES ____NO
If NO, do not use meter and return to IH lab.

Field Sample #	Test Numbers				Item or Room Equivalent	Component	Substrate	Area (SF)	Average XRF Result (ug/SF)	Laboratory Result (ug/SF)

ug/SF **=** micrograms per square foot

Comments:

Return completed form with instrument to: IH Lab

BROOKHAVEN NATIONAL LABORATORY SAFETY & HEALTH SERVICES DIVISION	**DIRECT READING INSTRUMENT** **NITON LBP X-Ray Fluorescence Meter (XRF)**
DATE:	SURVEYOR(S):

Remember to verify calibration on closeout (see front page)

Field Sample #	Test Numbers				Item or Room Equivalent	Component	Substrate	Area (SF)	Average XRF Result (ug/SF)	Laboratory Result (ug/SF)

Sample Location Drawing (optional)

BROOKHAVEN NATIONAL LABORATORY

IH103910 Attachment 9.5

HP-IHP-103910

Environmental, Safety, Health & Quality Directorate
SHSD Industrial Hygiene

Detection of Lead in Surface Wipes by the NITON XL700 X-Ray Fluorescence Meter- Qualified Sampler

Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:

Knowledge of the Principles of the Hazard and the Method

Criteria	Qualifying Standard	Unsatis-factory	Recov-ered	Satisf-.actory
Hazard Analysis	Understands the need to perform a hazard analysis of the sampling area and potential exposure to the sampler.			
Personal Protective Equipment	Understands the need to be aware of the potential lead contamination to sampler and knows how to determine the need for PPE.			
Sampling Protocol	Understands the exposure monitoring logic necessary to appropriately select sampling locations to accurately measure worker, public and environmental exposure potential.			
Analysis of data	Understands the need to perform analysis on the sampling data to assess potential exposure to the sampler, worker, public and environment, and to recommend corrective actions as necessary, and employee notification.			

Practical Skill Evaluation: Demonstration of Field Methodology

Criteria	Qualifying Performance Standard	Unsatis-factory	Recov-ered	Satisf-.actory
Sampling Equipment	Knows where equipment needed for the procedure is located and how to properly sign it out.			
Preparation of the meter	Understands the importance of calibrating the meter prior to use.			
Placement of Meter	Demonstrates the proper placement of the meter in the testing apparatus.			
Sampling Repetition	Understands the importance of multiple readings of locations and multiple analysis of the wipe sample to obtain confidence in the readings. .			
Record forms	Shows how to correctly and completely fill all forms associated with this SOP.			
Data Analysis	Shows how to correctly have the data analyzed and compared to occupational exposure limits and surface limits.			
Employee Notification	Knows how to timely and properly notify workers and management of over exposure or contaminated surfaces.			

Employee: I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:

Evaluator: I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date: